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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/057,745	10/26/2001	Kang-yoon Lee	5649-925	2804

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EXAMINER

LUU, CHUONG A

ART UNIT PAPER NUMBER

2825

DATE MAILED: 09/08/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/057,745

Applicant(s)

LEE ET AL.

Examiner

Chuong A Luu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 August 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 10-13, 15-18, 20, 21, 31-36 and 38-45 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 15-18, 20, 21, 31-36 and 38-45 is/are allowed.
- 6) ☒ Claim(s) 10-13 and 40-45 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

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DETAILED ACTION

The Finality of the last Office Action has been withdrawn.
Applicant's arguments with respect to claims 10-21 and 31-46 have been

considered but are moot in view of the new ground(s) of rejection.

PRIOR ART REJECTIONS

Statutory Basis

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The Rejections

Claims 10-13 and 40-43 are rejected under 35 U.S.C. 102(b) as being anticipated by Witek (U.S. 5,886,382).

Witek discloses a method of forming a trench transistor structure with

(10) forming a trench (37) in a substrate (35) (see Figure 15);
forming an isolation layer (38) comprising an insulating material in the trench (37)
so as to cover a first sidewall portion of the trench (37) (see Figure 15);
forming an impurity layer (42) in the second sidewall portion of the trench (37)
(see Figure 15);
forming a gate electrode (50a) on the second sidewall portion of the trench (37)
(see Figure 15);
(11) wherein forming the gate electrode comprises: forming a gate insulating
layer (38 or 48) on the second sidewall portion of the trench (37); forming the gate
electrode (40a or 50a) on the gate insulating layer (38 or 48) (see Figure 15);
(12) wherein forming the isolation layer comprises: forming a buffer layer (38) in
the trench; and forming the isolation layer (48) on the buffer layer (38) in the trench (37)
(see Figure 15);
(13) wherein forming the isolation layer comprises: forming a liner layer on the
buffer layer; and forming the isolation layer (48) on the liner layer (38) in the trench (37)
(see Figure 15);
(40) forming a mesa structure (37- the trench) having sidewalls and a top surface
in a substrate (35) (see Figure 15);
forming an impurity layer (42) in the top surface and the respective upper
portions of the sidewall (see Figure 15);

forming a gate electrode (50a) on the mesa structure (37- the trench) that extends across the top surface and down respective upper portions of the sidewall (see Figure 15);

(41) wherein forming the gate electrode comprising: forming a gate insulating (38 or 48) on respective upper portions of the sidewall; forming a gate electrode (40a or 50a) on the gate insulating layer (38 or 48) (see Figure 15);

(42) forming an isolation layer comprising an insulating material on respective lower portions of the sidewall (see column 5, lines 54-56. Figures 12 and 15);

(43) wherein forming the mesa structure comprising: forming a pair of trenches on opposing sides of the mesa structure; and wherein forming the isolation layer comprising: forming the isolation layer in the respective trenches so as to cover the respective lower portions of the sidewall (see Figure 26).

Claims 44-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Witek (U.S. 5,886,382) in view of Chen et al. (U.S. 6,013,551).

Witek teaches everything above but fails to form a buffer layer in the respective trenches; forming the isolation layer on the buffer layer in the respective trenches; wherein forming the isolation layer further comprises: forming a liner layer on the buffer layer; forming the isolation layer on the liner layer in the respective trenches. However, Chen discloses a method of manufacturing a self-aligned floating gate with (44) wherein forming the isolation layer further comprises: forming a buffer layer in the respective trenches; forming the isolation layer on the buffer layer in the respective trenches (see

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Figures 2D-2E); (45) wherein forming the isolation layer further comprises: forming a liner layer on the buffer layer; forming the isolation layer on the liner layer in the respective trenches (see Figures 2D-2E). It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Witek and Chen to form a liner layer, a buffer layer and an isolation layer to protect the trenches during fabrication process to obtain a semiconductor device to exceed its performance criteria.

Allowable Subject Matter

Claims 15-18, 20-21, 31-36 and 38-39 are allowed.

The following is an examiner's statement of reasons for allowance: The examiner has reviewed the prior art in light of applicant's claimed invention and finds that the claims define over the prior art. The prior art does not disclose or suggest inter alia the limitations "...filling an entire bottom of the trench with an insulating material so as to cover a first portion of the sidewall and to expose a second portion of the sidewall...."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chuong A Luu whose telephone number is (703) 305-0129. The examiner can normally be reached on M-F (7:30-4:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (703) 308-1323. The fax phone

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numbers for the organization where this application or proceeding is assigned are (703) 872-9306 for regular communications and (703) 872-9306 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

CAL
August 22, 2003

C. Everhart
CARIDAD EVERHART
PRIMARY EXAMINER